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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|-------------------------------|------------------|
| 10/726,450 | 12/02/2003 | Anthony I. Chou | YOR920030451US1 (8728-657) | 6760 |
| 46069 | 7590 | 08/26/2005 | EXAMINER | |
| F. CHAU & ASSOCIATES, LLC 130 WOODBURY ROAD WOODBURY, NY 11797 | | | LEE, CALVIN | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2818 | |
| DATE MAILED: 08/26/2005 | | | | |

Please find below and/or attached an Office communication concerning this application or proceeding.

AS

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|------------------------------|-------------------------------|-----------------------------|--|
| Office Action Summary | Application No. 10/726,450 | Applicant(s) CHOU et al. | |
| | Examiner Lee, Calvin | Art Unit 2818 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on August 15, 2005 (Remark).
2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4-29 and 31-34 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1,4-29 and 31-34 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 02 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
 * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

FINAL ACTION

Claim Rejections - 35 U.S.C. § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 6-29, and 31-34 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Khare et al* (US 2002/0130377) in view of *Chiou et al* (US 2002/0094593).

a) *Khare et al* discloses a method of forming a dielectric layer, comprising the steps of:

-growing an oxynitride dielectric layer **24** having a thickness of 15Å [¶ 0018]

-performing a plasma nitridation of the oxynitride layer [¶ 0019-0020]

Khare et al suggests the anneal treatment at about 550°C [¶ 0027], but not explicitly at suggest at a temperature of about 400°C for about 20 min. First of all, *Khare et al* suggest a temperature reasonably close to the claimed temperature range, prima facie obviousness is established due to the expectation of similar results for similar ranges. See *Titanium Metals Corp. of America vs. Banner*, 778 F.2d 775, 783.

b) Although *Khare et al* is silent about the anneal time, the examiner takes the Office Notice of the anneal time is notoriously well known in the art as seen by *Chiou et al* teaching to anneal an oxynitride layer in a mixture of N₂/O₂ at a temperature of about 300 °C and 900 °C for a time range between about 1 min and about 30 min [¶ 0036].

It would have been obvious to one having ordinary skill in the art to have modified the anneal of *Khare et al* by utilizing the anneal temperature and time, suggested by *Chiou et al*, because one would adjust either temperature or time to result in the most effective nitridation of the dielectric layer.

c) Since *Chiou et al* discloses such annealing does not require oxygen (“nitrogen ambient,” paragraph 0019), *Chiou et al* inherently teaches or suggest the annealing is performed in a nitrogen ambient including an oxygen concentration of less than 1 part per billion.

d) In re claims 7-9, since *Khare et al* discloses the oxynitride gate dielectric in a semiconductor device, *Khare et al* inherently teaches or suggests that such semiconductor device is selected from a group comprising conventional devices such as: FET, MIM capacitor, etc. For reference, US 6,420,739 to *Yokoi* discloses a conventional semiconductor device having an FET, a semiconductor resistor element, and an MIM capacitor [Figs. 1A-1H and col. 1].

e) In re claims 16-28, the combination of *Khare et al* and *Chiou et al* reads on features of claim 16 comprising the step of cooling the semiconductor device since the device of *Khare et al* would eventually be cooled off.

3. Claim 4-5 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Khare et al* and *Chiou et al* in view of *Basceri et al* (US 6,525,365).

Khare et al teaches a gate dielectric for an integrated circuit device, but is silent about the device gate. Although *Chiou et al* does not suggest the gate/electrode metal being aluminum, *Chiou et al* discloses “it is not necessary to uses an especial metallic material of the ohmic electrode” [col. 3, ln.33]. Nevertheless, such gate electrode of aluminum capping a dielectric is known in the semiconductor as evidenced by *Basceri et al* disclosing a dielectric 34 sandwiched between bottom and top gate electrodes 32, 36 of aluminum [Fig. 1 and col. 14]

It would have been obvious to one having skills in the art to have modified the process of *Khare et al* and/or *Chiou et al* by utilizing aluminum gate/electrode because it appears as if any electrode material including the claimed electrode aluminum would work equivalently to any other well-known electrode metal as long as the desired electrode metal material has a lower etch rate than its gate dielectric.

Response to Arguments

4. Applicants argued that “Khare discloses a two step process for growing an oxynitride layer, but does not include a subsequent ‘annealing’ step for annealing the oxynitride layer. The Examiner notes that the plasma nitridation in Khare is mainly for “a reduction in the mean leakage current ... nitridation results in even further improved dielectric performance.” However, “an ultra thin gate dielectric having an increased nitrogen concentration may be formed without a significant corresponding increase in the overall film physical thickness” or “a nitridation of an oxynitride layer will result in less additional growth of the layer than would be the case of an oxide layer.” Much better, “a final oxynitride gate layer is formed with improved dielectric properties and reduced thickness. Therefore, the Khare ‘s nitridation is the same or similar to the claimed annealing process. Now the temperature although is not explicitly the same as the claimed temperature of 400°C, Khare suggests different temperatures such as: RPN at 550°C (having a deviation of 0.0246) and 750°C (having a deviation of 0.0296). It’s a matter of process choice. In addition, *Chiou et al* suggesting three annealing temperatures being utilized, i.e., 300°C, 600°C and 900°C in the annealing of the silicon oxynitride is perfect to establish a *prima facie* case of obviousness against the annealing conditions, i.e., the temperature of 400°C, of the pending claims

Note in the above rejections, the specific portions of *Khare et al* in view of *Chiou et al* have been pointed out in detail. Therefore, a rejection above has been made FINAL.

5. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire three months from the mailing date of this action. In the event a first reply is filed within two months of the mailing date of this final action and the advisory action is not mailed until after the end of the three-month shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than six months from the date of this final action.

Contact Information

6. Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at (571) 272-1896 on Mondays thru Thursdays 6:30-4:30PM. If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2818's Supervisory Patent Examiner *David Nelms* can be reached at (571) 272-1787. The fax phone number for the organization (where this application is assigned to) is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system at <http://pair-direct.uspto.gov>. Should you have questions on access to the PAIR system, contact the Electronic Business Center at (866) 217-9197.



David Nelms
Supervisory Patent Examiner
Technology Center 2800

Date: August 24, 2005